

REMARKS

Claims 1-19 were examined and rejected in the above-identified final Office Action and Advisory Action. Applicants amend claims 1, 4-8, 11-14, and 17-19. Applicants submit additional claims 20-22. Applicants assert that no new matter is added herein. Specifically, amendments to the claims are supported by page 3, lines 8-10, page 3, lines 20-35, page 4, lines 4-6, and page 2, lines 13-16 which support the concept that a branch instruction can be re-encountered before a branch target is calculated by a decoder and before the branch instruction is fully executed. Applicants respectfully request reconsideration of claims 1-19 and consideration of additional claims 20-22 in view of at least the following remarks.

I. Claims rejected under 35 U.S.C. § 103

Claims 1, 4-8, 11-14, and 17-19

Claims 1, 4-8, 11-14, and 17-19 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Publication No. 005774710A to Chung (Chung) in view of U.S. Publication No. 005878255A to Tran et al. (Tran). To render a claim obvious, all elements of that claim must be taught or suggested by at least one properly combined reference.

Applicants respectfully disagree with the rejection above of independent claim 1 and asserts that claim 1 is not taught or suggested by the cited references for at least the reason that independent claim 1, as amended, requires calculating a target for the re-encountered branch instruction by accessing the target stored prior to determining a target for the re-encountered branch instruction using the decoder and before the first occurrence of the first occurrence of the branch instruction is fully executed. Specifically, according to claim 1, for example, a branch instruction may be fetched and its target decoded and stored. Then, when the branch instruction is re-fetched later, the stored target may be used to perform further fetches prior to processor execution of the instance of that branch instruction fetched the first time and prior to again decoding the target from the re-fetched branch instruction by accessing the stored previously decoded target for that branch instruction previously fetched.

In the final Office Action, the Patent Office notes that Chung “does not that mention that the target of the branch instruction is stored before the branch [instruction] is fully executed.” As to this claim limitation, the Patent Office asserts that Tran teaches “branch targets (successor index col. 10 lines 21-27)” (see section 8 of the Office Action), and that “successor index which is used for addressing the instruction cache to fetch the branch instruction’s predicted successor (target)” (see section 49 of the Office Action).

Tran refers to updating branch prediction information speculatively, or before the branch is fully executed. (See col. 2, lines 63-64) For example, Tran teaches that a successor index is used to index a cache to fetch an instruction prior to execution of a previous branch. Specifically, the successor index of Tran is an index used to look up the successive instruction in instruction cache storage 252. For example, for a program sequence where a first conditional branch enters a pipeline, before that branch is executed, a prediction will be made so the pipeline will continue to fetch and process instructions. Then, if a second conditional branch is loaded into the pipeline based on the target prediction for the first branch, another prediction will have to be made so the pipeline can continue to fetch instructions. However, the second prediction may be considered “doubly speculative” because it depends on the execution of the first conditional branch as well as the second conditional branch. Thus, if the first prediction is incorrect, the second prediction is irrelevant.

However Tran fails to teach or suggest calculating a target for a re-encountered branch prior to execution of a prior occurrence of that branch and prior to determining a target for that re-encountered branch using a decoder, as required by amended independent claim 1. Hence, since neither Chung, Tran, nor the combination teaches or suggests the limitations of amended claim 1 mentioned above, Applicants respectfully request the Patent Office withdraw the rejection identified above for claim 1.

Regarding Claims 4-7, Applicants submits that these claims are not obvious in view of the cited references at least for the same reasons given in connection with independent Claim 1 from which they depend. Hence, Applicants respectfully request the Patent Office withdraw the rejection identified above for claims 4-7, for at least the same reasons as noted.

As to independent Claim 8, Applicant respectfully submits that the combination of Chung and Tran fails to disclose or suggest a branch prediction unit to, upon re-encountering the branch instruction before the first occurrence of the branch instruction is fully executed, predict a target of the re-encountered branch instruction by accessing the target of the first occurrence of the branch instruction stored in the cache prior to determining a target for the re-encountered branch instruction using the decoder and before the first occurrence of the branch instruction is fully executed, as required in this amended claim. The arguments above with respect to claim 1 apply to claim 8 as well. Hence, Applicants respectfully request the Patent Office withdraw the rejection identified above for claim 8, for at least the same reasons as noted above for claim 1.

Regarding Claims 11-13, Applicants submits that these claims are not obvious in view of the cited references at least for the same reasons given in connection with independent Claim 8 from which they depend. Hence, Applicants respectfully request the Patent Office withdraw the rejection identified above for claims 11-13 for at least the same reasons as noted.

Similarly, as to independent Claim 14, Applicant respectfully submits that the combination of Chung and Tran fails to disclose or suggest a branch prediction unit to, upon re-encountering the branch instruction before the first occurrence of the branch instruction is fully executed, predict a target of the re-encountered branch instruction by accessing the target of the first occurrence of the branch instruction stored in the cache prior to determining a target for the re-encountered branch instruction using the decoder and before the first occurrence of the branch instruction is fully executed, as required in this amended claim. The arguments above with respect to claim 1 apply to claim 14 as well. Hence, Applicants respectfully request the Patent Office withdraw the rejection identified above for claim 14, for at least the same reasons as noted above for claim 1.

Regarding dependent Claims 17-19, Applicants submits that these claims are not obvious in view of the cited references at least for the same reasons given in connection with independent Claim 14 from which they depend. Hence, Applicants respectfully request the Patent Office withdraw the rejection identified above for claims 17-19, for at least the same reasons as noted.

Claims 2, 3, 9, 10, 15 and 16

In the Office Action, Claims 2, 3, 9, 10, 15 and 16 are rejected under 35 U.S.C. §103(a) as being unpatentable over Chung in view of Tran and further in view of U.S. Publication No. 006601161B2 to Rappoport et al. (Rappoport). Applicant respectfully traverses this rejection.

As Claims 2, 3, 9, 10, 15 and 16 are each respectively dependent on independent Claims 1, 8 and 14, the discussion above with regard to the independent claims and the cited references applies here. Because the combination of Chung and Tran does not contain limitations recited in Applicant's independent claims as set forth above, and because Rappoport does not cure these deficiencies, the combination of Chung, Tran and Rappoport does not teach or suggest Applicant's dependent claims. Therefore, Claims 2, 3, 9, 10, 15 and 16 are patentable over Chung in view of Tran and further in view of Rappoport. Hence, Applicants respectfully request the Patent Office withdraw the rejection identified above for claims 2, 3, 9, 10, 15 and 16, for at least the same reasons as noted.

CONCLUSION

In view of the foregoing, it is submitted that the claims are in condition for allowance. Reconsideration of the rejections and objections is requested. Allowance is earnestly solicited at the earliest possible date. If there are any fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666. If a phone interview would expedite the prosecution of this Application, the Patent Office is invited to contact the undersigned at (310) 207-3800.

Respectfully submitted,

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